OB & OD Munition Emissions Database Guidance

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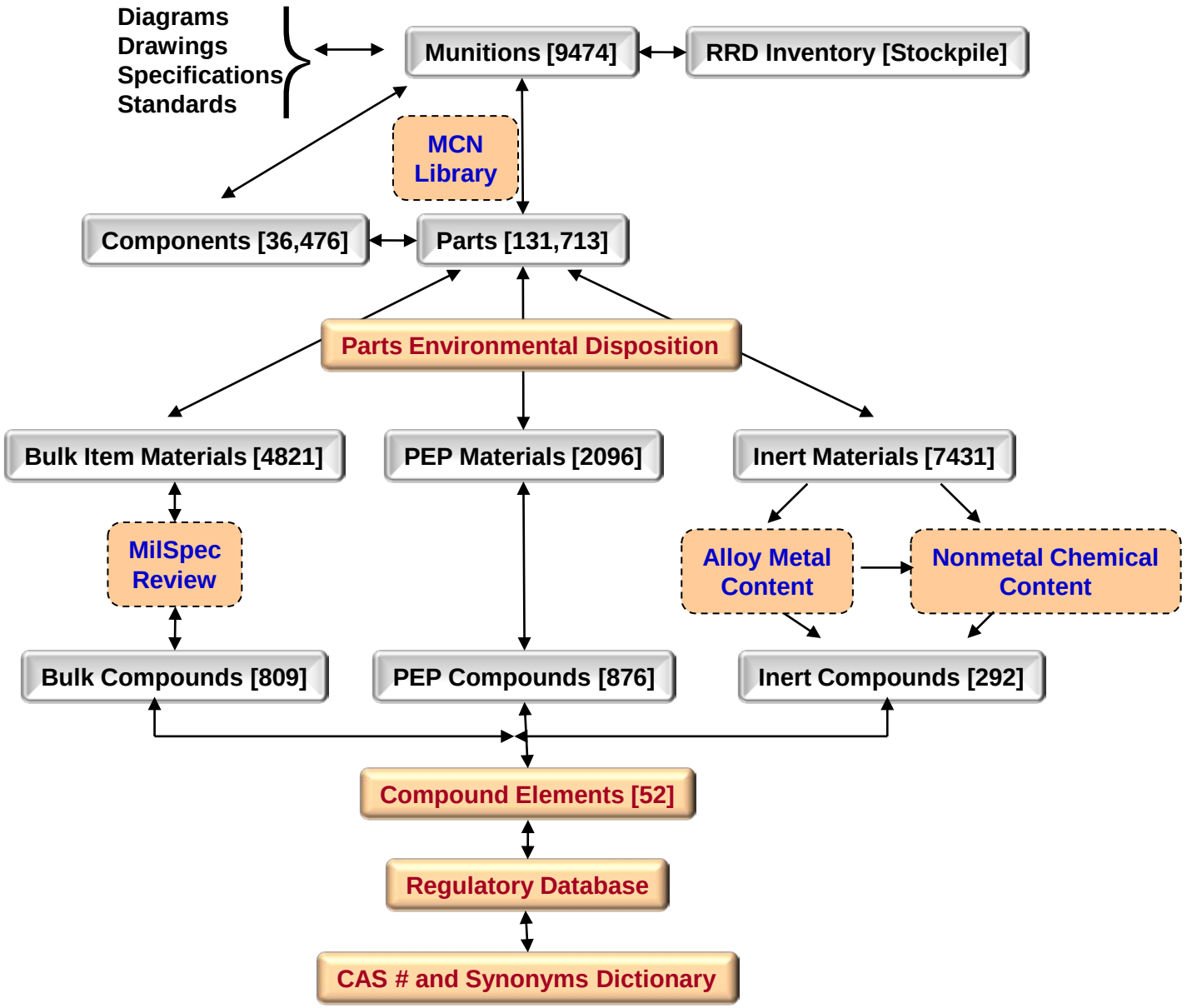
Overview

- Background Databases – MIDAS, R-CPD
- OB/OD Emissions Database Origin & Evolution
- Current Guidance
- OB/OD Emissions Impact
- MACS Utilization
- Future Programs

Available Resources – MIDAS Munition Characterization Database



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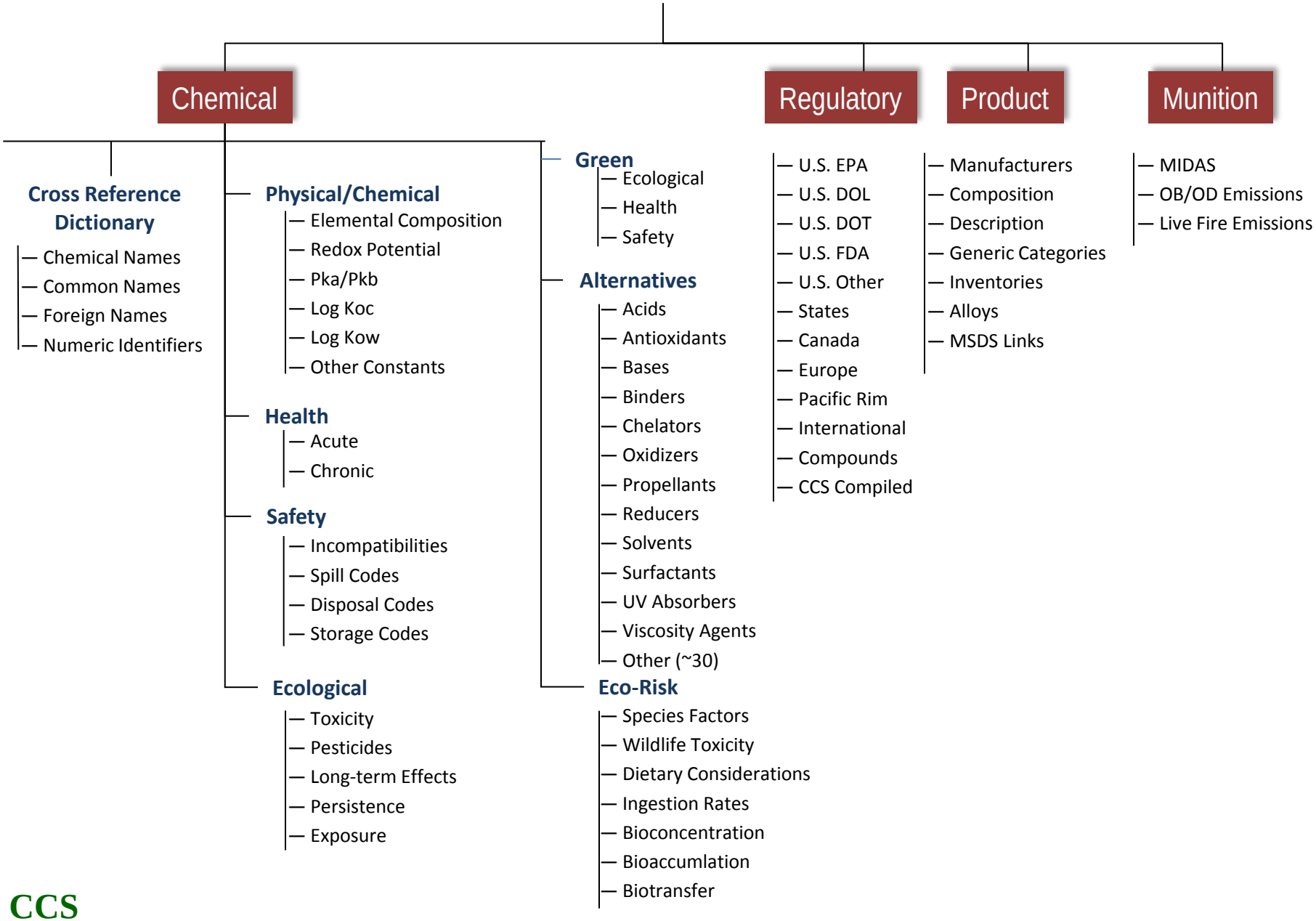
Available Resources – CCS Relational Chemical and Product Database (R-CPD)



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HEADQUARTERS
U.S. ARMY ARMAMENT,
MUNITIONS AND CHEMICAL COMMAND

FINAL REPORT

DEVELOPMENT OF METHODOLOGY AND TECHNOLOGY FOR IDENTIFYING AND QUANTIFYING EMISSION PRODUCTS FROM OPEN BURNING AND OPEN DETONATION THERMAL TREATMENT METHODS.

FIELD TEST SERIES A, B, AND C

VOLUME 1
TEST SUMMARY

JANUARY 1991

Maintenance Management Division
Demilitarization and Technology Branch
Rock Island, Illinois 61299-6000
DSN: 793-3980/5534
Commercial: 309-782-3980/5534

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EPA/600/R-08/103

Emission Factors for the Disposal Of Energetic Materials by Open Burning and Open Detonation (OB/OD)

By

William J. Mitchell and Jack C. Suggs
US Environmental Protection Agency, MD-46
Research Triangle Park, NC 27711

AUGUST 1998

This emission factor database
was created using data collected
by the U.S. Department of Defense

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Munition Emissions Advisory Group (MEAG) - 2001

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Initial OB & OD Chemical Release Databases

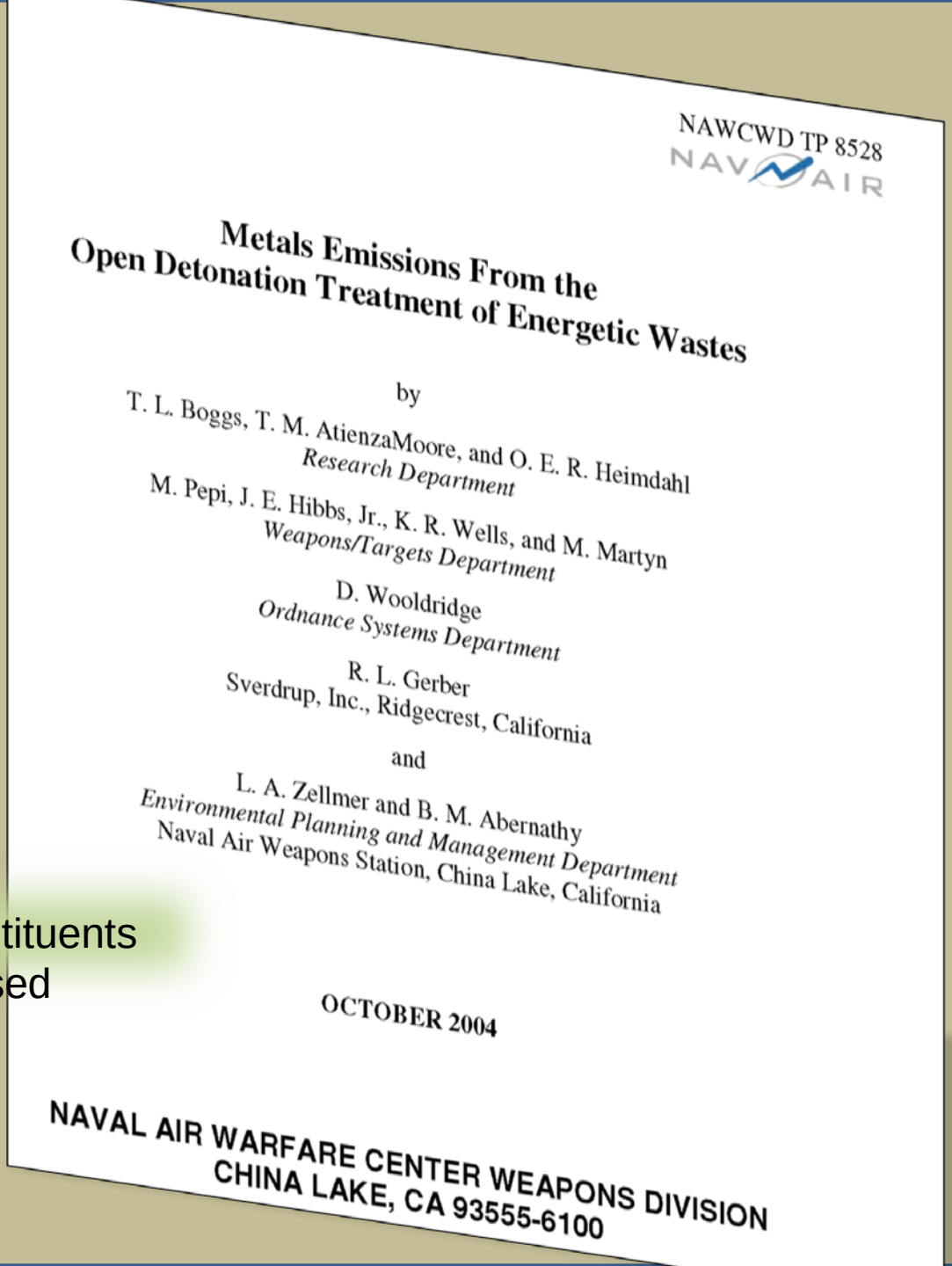
Parameter	OB-CRD	OD-CRD
No. Test Materials Included	19	29
No. Plumes Characterized	52	122
Explosive Weights Characterized (NEW)	1-7000 lbs	0.3-2000 lbs

Summary Statistics for the OB Emission Data Sets

EP/EP Category	Units	N	Mean	RSD(a)	Quality Rating
PM-10	lb/lb NEW	13	1.5E-01	1.89	B
Carbon Dioxide	lb/lb C	15	3.5E+00	0.13	A
Carbon Monoxide	lb/lb C	15	7.8E-03	1.46	B
Sulfur Dioxide	lb/lb NEW	8	3.0E-04	1.31	B
Nitrogen Oxides	lb/lb N	13	3.5E-02	0.71	A
Hydrogen Chloride	lb/lb Cl	2	8.9E-01	0.07	B
Energetic Compounds	lb/lb Energetic	4	1.0E-09	0.32	B
SVOCs	lb/lb SVOC	6	1.9E-07	1.93	B
Benzene	lb/lb C	11	1.2E-04	1.93	B
TNMHC	lb/lb C	13	5.0E-04	1.24	B
Acetylene	lb/lb C	7	1.4E-04	1.49	B
Ethylene	lb/lb C	4	2.2E-05	0.22	B
Isobutene	lb/lb C	5	1.1E-05	1.78	C
Propylene	lb/lb C	4	5.8E-06	0.64	B
Naphthalene	lb/lb C	4	1.1E-07	1.27	C
Metals from elemental metal particles in the energetic	lb/lb Metal	2	4.2E-02	0.43	C
Metals from metal compounds in the energetic	lb/lb Metal	2	6.7E-01	0.09	C

Summary Statistics for the OD Emissions Data Sets

EP/ EP Category	Units	N	Mean	RSD(a)	Quality Rating
PM-10	lb/lb NEW	5	7.7E+00	0.47	D
Carbon Monoxide	lb/lb C	23	7.1E-02	0.81	B
Carbon Dioxide	lb/lb C	22	3.5E+00	0.09	B
Sulfur Dioxide	lb/lb NEW	12	4.8E-04	0.88	B
Nitrogen Oxides	lb/lb N	19	2.9E-02	0.69	B
Energetic Compounds	lb/lb Energetic	5	4.5E-07	1.95	C
SVOCs	lb/lb SVOC	All Values BDL (Lowest MDL = 2E-08 lb/lb SVOC).			
Benzene	lb/lb C	23	2.0E-04	0.82	B
TNMHC	lb/lb C	23	7.7E-03	1.03	B
Acetylene	lb/lb C	18	7.7E-04	0.80	B
Ethylene	lb/lb C	18	7.1E-04	1.05	B
Methylene Chloride	lb/lb C	18	6.2E-04	1.05	B
Propylene	lb/lb C	18	1.3E-04	1.08	B
Toluene	lb/lb C	17	6.7E-05	0.85	B
Naphthalene	lb/lb C	5	2.7E-06	5.6E-01	C
Metals from elemental metal particles in the energetic	lb/lb Metal	3	9.8E-02	0.47	D
Metal alloy particles from casings and other metal alloys, including solder	lb/lb Alloy	35	3.1E-02	1.35	D
Metals from metal compounds in the energetic	lb/lb Metal	10	2.6E-01	1.04	D
Metals from painted and plated parts	lb/lb Metal	1	Summary statistics cannot be calculated because there is only one EF (3.8E-03 lb/lb Metal)		D



NAWCWD TP 8528

Metals Emissions From the Open Detonation Treatment of Energetic Wastes

by

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OCTOBER 2004

NAVAL AIR WARFARE CENTER WEAPONS DIVISION
CHINA LAKE, CA 93555-6100

Casing
Hazardous Constituents
NOT Released

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Recommended EFs for OB and OD Events

EP/EP Category	Units	OB	OD	
			Unconfined	Buried and Soil-Covered
PM-10	lb/lb NEW	1.5E-01	7.7E+00	1.1E+01
Carbon Monoxide	lb/lb C	7.8E-03	7.1E-02	2.0E-01
Carbon Dioxide	lb/lb C	3.5E+00	3.5E+00	3.0E+00
Nitrogen Oxides	lb/lb N	3.5E-02	2.9E-02	4.8E-02
Sulfur Dioxide	lb/lb S	2.0E+00	2.0E+00	2.0E+00
Hydrogen Chloride	lb/lb Cl	8.9E-01	NA	NA
Energetic Compounds	lb/lb Energetic	1.0E-09	4.5E-07	2.0E-06
SVOCs	lb/lb SVOC	1.9E-07	1.0E-08	2.0E-08
Benzene	lb/lb C	1.2E-04	2.0E-04	4.0E-04
TNMHC	lb/lb C	5.0E-04	7.7E-03	3.4E-02
Acetylene	lb/lb C	1.4E-04	7.7E-04	1.8E-03
Ethylene	lb/lb C	2.2E-05	7.1E-04	2.3E-03
Methylene Chloride	lb/lb C	NA	6.2E-04	1.5E-03
Isobutene	lb/lb C	1.10E-05	NA	NA
Propylene	lb/lb C	5.8E-06	1.3E-04	4.1E-04
Toluene	lb/lb C	NA	6.7E-05	1.3E-04
Naphthalene	lb/lb C	1.1E-07	2.7E-06	3.8E-06
Metals from elemental metal particles in the energetic	lb/lb Metal	4.2E-02	9.8E-02	7.5E-02
Metal alloy particles from casings and other metal alloys, including solder	lb/lb Aloy	NA	3.1E-02	1.5E-02
Metals from metal compounds in the energetic	lb/lb Metal	6.7E-01	2.6E-01	5.2E-01
Metals from painted and plated parts	lb/lb Metal	NA	3.8E-03	3.8E-03

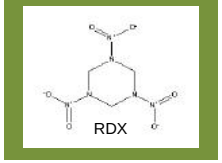
Munitions Analytical Compliance Suite (MACS)

MACS–1
Demil
(Web)

Dispersion RISK
(Web)

INC–FRCS
(Web)

MACS–COC
Chemicals of Concern
(Web)



MACS CENTRALIZED DATABASES

- Munitions Characterization — MIDAS
- Demil Processes
- Constituent Chemicals
- Chemicals Released
- Concern Criteria
- Green Criteria
- Health Data
- Environmental Data
- Safety Data
- Transportation/Storage Factors
- Hazardous Waste Forms
- Regulations

MACS–PRA
Permit Repository & Assets (Web)

MACS–ERA
Emission Risk
(Web)

MACS–OBODM
Plume Height
(Web)

MACS–AERMOD
Air Dispersion
(Web)

MACS–MODFLOW
Water Dispersion & Deposition
(Web)

MACS–GIS
Geographical Info
(Web)

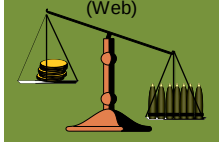
MACS–2
Ranges
(Web)

RATS
Range Assembly
(Concept)

TRACS
Munitions & Waste
(Web)

MACS–HRA
Health Risk
(Web)

MACS–3
Theoretical Compliance Analyses
(Web)



G–MACS
Green Munitions
(Web)

GM–PEAS
DfD Process Engineering
(pending)

GM–PACS
Green Munitions Mfr. Process (Web)

GM–WACS
Green Waste
(Web)

MACS–EnRA
Environmental Risk
(Web)

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Demil Chemical of Concern (COC) Analysis

- 11 Years of MACS-1 Data (1999-2009)
- 13 Demil Sites Combined
- 173,000,000 lbs PEP & Bulk Chemicals Demil'd
- 300 Unique Chemicals in PEP & Bulk Materials
- 30 Chemicals Accounted for 98% of Total Poundage
- 28/30 Large Volume Chemicals from PEP
- 2/30 Large Volume Chemicals from Bulk (Zinc Chromate & Zinc Phosphate)
- 63,000,000 lbs Nitrocellulose Processed – 0.06 lbs Released by OB
- 33,000,000 lbs RDX Processed – 66 lbs Released by OD

OB & OD Emission Testing Data Gaps

OB Data Gaps	OD Data Gaps
• Metals in energetic – as compounds & particulate	• Ordnance metal location – energetic, coating, components
• Energetics	• Respirable particulate composition
• SVOCs/POMs in energetics	• Energetics
	• SVOCs/POMs in energetics
	• Perchlorate & chlorine emissions
	• Buried detonation emission – differences
	• OD source configuration

Ongoing 4-Phase Detonation Chamber Testing Program

PHASE I
– Develop Reproducible Chamber Testing Procedure
– Validate for Metal & Energetic Emissions

PHASE II
– Assess Emission Variability for Various Energetics
– Correlate Emission Ratios With Elemental Content
– Determine Emissions for Various Metal Sources (*Cartridge, Energetics, Coatings*)
– Compare Emissions for Pure Energetic vs. Complex Munition

PHASE III
– Evaluate Factors Affecting Sulfur & Chlorine Emissions

PHASE IV
– Open Field Tests
– Evaluate Factors Potentially Affecting Detonations
– (*Donor Placement, Stacking Geometry, "Quenching"*)

“The Flyer”

EPA-developed
Field Sampling Device

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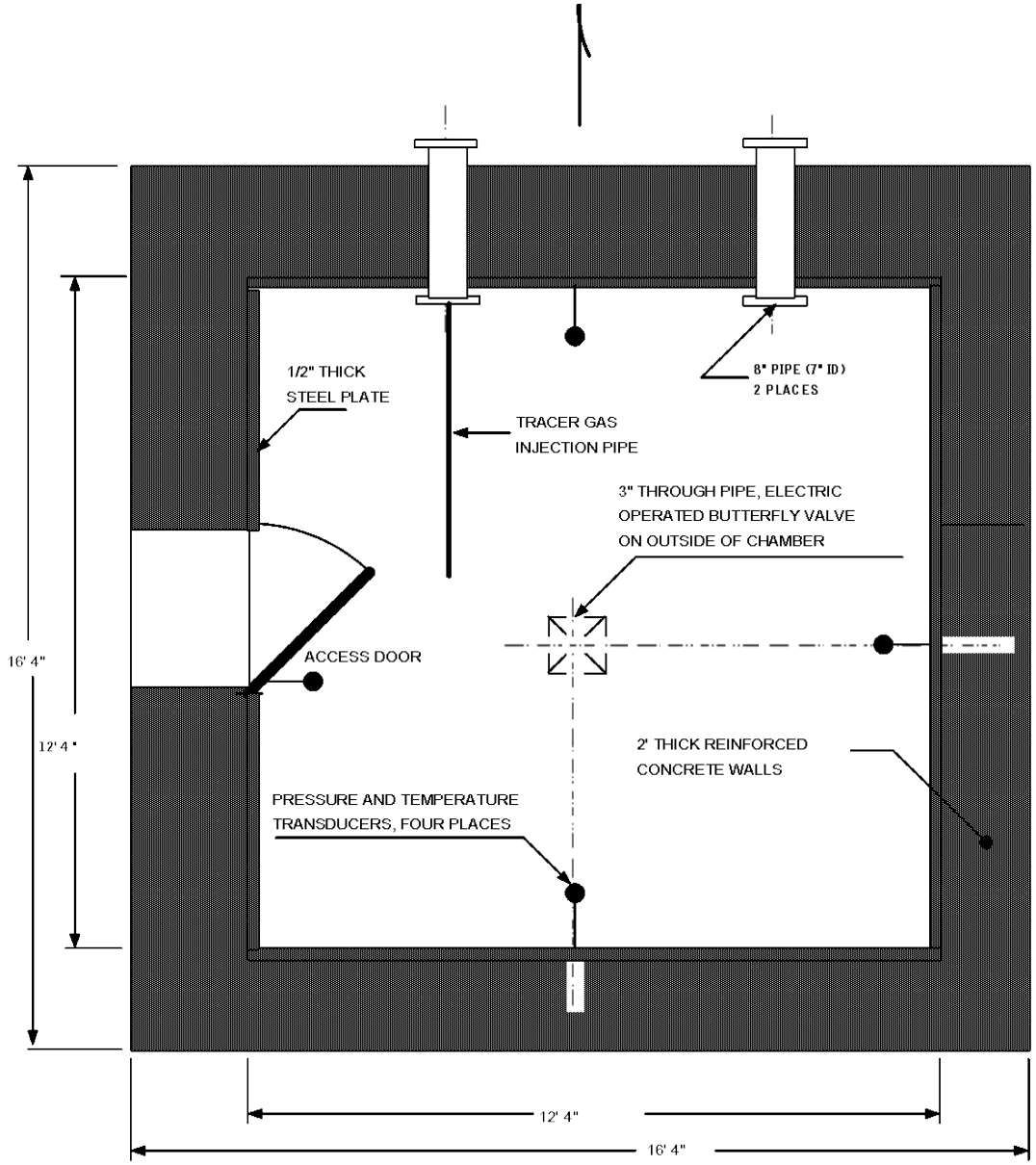
Schematic of the USN Detonation Chamber



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Conclusions

- Credible emissions data for OB & OD have been compiled
- Ongoing research will fill identified data gaps
- 5 Automated and Web-based MACS modules use the existing emissions data
- Alloy constituent chemicals are NOT released into the environment
- OB & OD are proven safe by application of emissions data

OB & OD Munition Emissions Database Guidance

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